Respiratory muscle training in persons with spinal cord injury: a systematic review
Van Houtte S, Vanlandewijck Y, Gosselink R

CRD summary
This review aimed to assess the effectiveness of respiratory muscle training on a number of clinical and health outcomes in individuals with spinal cord injury. Small data sets, lack of head-to-head comparisons and clinical differences between the studies limit interpretation of the results. However, the authors' conclusion that there were insufficient data to draw robust conclusions seems appropriate.

Authors' objectives
To assess the effectiveness of respiratory muscle training (RMT) on a number of clinical and health outcomes in individuals with spinal cord injury (SCI).

Searching
MEDLINE was searched from 1980 to November 2004; the search terms were reported. The references from relevant papers were also checked. Only English language papers were considered for inclusion.

Study selection
Controlled studies investigating the effects of RMT in people with SCI were eligible for inclusion. Studies with training programmes that used glossopharyngeal breathing, abdominal binding, electrostimulation, phrenic nerve pacing or general exercise training were excluded. The included interventions were pectoralis muscle training, progressive expiratory loading on accessory muscles by means of \( P_{\text{flex}} \), ventilatory muscle trainer, resistive inspiratory muscle training, target flow training and maximal sustained inspiration training. The level of lesion of included participants ranged from C3 to C8. Most of the participants were male and the mean age was 32 years. Standard clinical measures of pulmonary function were included in the review; a full list was reported in the paper.

One reviewer selected papers for inclusion in the review.

Assessment of study quality
The methodological quality of the controlled studies was assessed using a modified version of the framework suggested by Smith et al. and Lotters et al. (see Other Publications of Related Interest nos.1-2). Studies were assessed in terms of randomisation, similarity of the groups, conintervention, masking, compliance, outcome measures, exercise regimen and follow-up. A total score was calculated for each study, ranging from 0 (lowest) to 40 (highest).

Two reviewers independently assessed the methodological quality of the included studies. Any disagreements were resolved through discussion.

Data extraction
Outcome data for the intervention and comparator groups were extracted and, where additional information was necessary, the review authors contacted the authors of the primary studies in order to calculate effect sizes for outcomes in each study.

The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction.

Methods of synthesis
The studies were combined in a narrative, owing to heterogeneity in the outcome variables and there being insufficient data to combine the studies using meta-analytic methods. Differences between the individual studies were reported in the tables and body of the text.
Results of the review

Six controlled studies (n=128) were included in the review.

The methodological quality score assigned to the included studies ranged from 15 to 29 (median 23). The main issues included lack of adequate description of the randomisation procedure, lack of similarity between the cointervention with the experimental intervention, and the absence of double-blinding.

Five studies examined respiratory muscle strength. No statistically significant between-group differences in inspiratory mouth pressure were found, based on two studies comparing inspiratory muscle training with a control group. Of two studies examining expiratory mouth pressure, one found a significant improvement in favour of the intervention group (expiratory muscle training) compared with no training. One study found an increase in pectoral strength from baseline in the intervention group, but no change in the control group; no between-group comparison was made.

Two studies provided inspiratory muscle endurance training. Both studies found that endurance improved from baseline in the intervention group following RMT, but no significant between-group differences were found.

Five studies examined the effect of RMT on vital capacity: one found a significant improvement with expiratory muscle training compared with a control group. Three studies examined the effect of RMT on residual volume: two studies providing inspiritional muscle training reported no changes in residual volume, while one study providing expiratory muscle training found a significant decrease in residual volume from baseline with RMT; however, no between-group comparisons were performed.

Respiratory complications, quality of life and exercise performance.

One study examined the effect of RMT on dyspnoea: a significant difference in favour of resistive inspiratory muscle training was found compared with no training. Another study looking at maximal sustained inspirations compared with no training reported some improvement in breathing during the exercise period; however, two patients were also reported to have increased spams and sputum production. One study examined the effect of RMT on exercise performance: peak oxygen consumption during incremental maximal arm cranking exercise significantly improved after RMT.

Authors’ conclusions

Trends for improvement were found after RMT for expiratory muscle strength, vital capacity and residual volume. There were insufficient data to draw any conclusions about the effect of RMT on inspiratory muscle strength, respiratory muscle endurance, quality of life, exercise performance and respiratory complications.

CRD commentary

The review addressed a clear question and was supported by clear inclusion and exclusion criteria. Only one database was searched and this search was restricted to papers published in English, thus it is possible that relevant studies were missed. Methods undertaken to select study papers were not likely to minimise reviewer error and bias. The validity of the included studies was assessed using methods likely to minimise reviewer error and bias. The total validity score was reported for each study, details of the individual components were lacking, and the results were not used in the interpretation of the results of the review. Few of the primary studies conducted head-to-head comparisons, and the presence of small data sets and clinical heterogeneity between the included studies limit interpretation of the results. However, the authors' conclusions seem appropriate.

Implications of the review for practice and research

Practice: The authors did not state any implications for practice.

Research: The authors stated that further randomised controlled trials are required to clarify the effect of RMT in persons with SCI.

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Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.